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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/603,703
Filing Date: June 25, 2003
Appellant(s): COTAL ET AL.

Carmen Santa Maria
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed June 5, 2007 appealing from the Office action mailed October 4, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

A substantially correct copy of appealed claim 12 appears on page 24 of the Appendix to the appellant's brief. The minor errors are as follows: line 5; spectral is misspelled "spectra!".

(8) Evidence Relied Upon

6,291,761	TAKADA et al.	9-2001
2002/0062858	MOWLES	5-2002
4,242,580	KAPLOW et al.	12-1980

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1 through 4, 7, 8 and 18 through 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takada et al. (U.S. 6,291,761) in view of Mowles (U.S.P.G.Pub 2002/0062858).

Takada discloses a solar cell module, shown in figures 3A, 3B, and 3C. The module comprises a photovoltaic energy source, 303, having a front face and an oppositely disposed back face, the top and bottom of the layer as seen in figure 3B, a frontside array of metallic gridlines, 305, and a busbar structure in electrical continuity with the frontside array comprising an electrical insulator layer, 308, and a metallic busbar layer, 306, which overlies the insulator layer and is in electrical continuity with the frontside array of metallic gridlines (figure 3A, 3B, and 3C and column 17, paragraphs 2 and 6 and column 18, paragraph 1).

Regarding claims 3 and 19, Takada further discloses the photovoltaic energy source comprises more than two layers of semiconductor material (column 17, paragraph 2).

Regarding claim 4, figure 3B further shows a backside metallic electrode, 301, overlying and contacting the back face of the energy source (column 16, paragraph 8).

Regarding claims 8 and 21, figure 3A also shows the insulator layer, 308, extends laterally beyond the metallic busbar, 306.

The differences between Takada and the claims are the requirement of exactly two layers of semiconductor material, and requirements of the insulator layer composition and thickness.

Mowles teaches a high efficiency solar cell produced with inexpensive materials. The photovoltaic layer comprises two semiconductor layers to produce a p/n junction (paragraph 0052). Mowles further teaches the use of an insulating layer to electrically isolate the device. The insulating layer is made of silicon dioxide and has a thickness of 0.5 micrometers (paragraph 0049).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the material and thickness of the insulating layer of Mowles within the device of Takada because silicon dioxide has low cost, high availability of source chemicals and advanced technology of its deposition (Mowles paragraph 0049). Also the thickness is optimized for the specific application of an insulating layer and needs only to be sufficiently thick enough to be electrically insulating and pin-hole free (Mowles paragraph 0049). Thus the thickness of Mowles

provides a low cost insulating layer free of defects that can corrupt the insulating properties of the layer. Therefore the combination meets claims 1, 3, 4, 7, 8 and 18 through 21.

It would have been further obvious to one having ordinary skill in the art at the time the invention was made to utilize the semiconductor materials and two layer structure of Mowles within the device of Takada because the material is low cost, efficiently absorbs the solar spectrum, efficiently transports the photogenerated carriers and provides the abrupt p/n junctions needed for an efficient photovoltaic device (Mowles paragraph 0052). Further the amorphous silicon utilized within the device of Takada has a short lifetime, difficult production and increased cost over the material of Mowles (Mowles paragraph 0012). Because both Takada and Mowles are concerned with solar cells, one would have a reasonable expectation of success from the combination. Thus the combination meets claim 2.

Claims 9 through 11, 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takada in view of Mowles as applied to claims 1 through 4, 7, 8 and 18 through 21 above, and further in view of Kaplow et al. (U.S. 4,242,580).

The disclosure of Takada in view of Mowles is as stated above for claims 1 through 4, 7, 8 and 18 through 21.

The difference between Takada and claims 9 through 11, 22 and 23 is the requirement of a solar concentrator of specific concentration ratio.

Kaplow teaches a solar radiation collection apparatus. The apparatus directs highly concentrated solar radiation upon a device such as a photovoltaic cell (abstract).

These concentrations exceed 100 suns and especially in the range of 500 or more suns (column 1, paragraph 1). Figure 1 shows the apparatus concentrates the solar energy toward the front face of solar cell 10.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the solar concentrator of Kaplow with the device of Takada in view of Mowles because the device allows the response of the cell to sun exposure to always be a maximum (Kaplow column 6, paragraph 2) and provides highly concentrated solar radiation to the solar cell (Kaplow column 2, paragraph 10). Because Kaplow and Takada in view of Mowles are concerned with photovoltaic cells, one would have a reasonable expectation of success from the combination. Thus the combination meets claims 9 through 11, 22 and 23.

Claims 12 and 14 through 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takada et al. (U.S. 6,291,761) in view of Mowles (U.S.P.G.Pub 2002/0062858) and further in view of Kaplow et al. (U.S. 4,242,580).

Takada discloses a solar cell module, shown in figures 3A, 3B, and 3C. The module comprises a photovoltaic energy source, 303, having a front face and an oppositely disposed back face, the top and bottom of the layer as seen in figure 3B, a frontside array of metallic gridlines, 305, and a busbar structure in electrical continuity with the frontside array comprising an electrical insulator layer, 308, and a metallic busbar layer, 306, which overlies the insulator layer and is in electrical continuity with the frontside array of metallic gridlines (figure 3A, 3B, and 3C and column 17, paragraphs 2 and 6 and column 18, paragraph 1).

Regarding claims 3 and 19, Takada further discloses the photovoltaic energy source comprises more than two layers of semiconductor material (column 17, paragraph 2).

Regarding claim 16, figure 3A also shows the insulator layer, 308, extends laterally beyond the metallic busbar, 306.

The differences between Takada and the claims are the requirements of the insulator layer composition and thickness and the requirement of a solar concentrator of specific concentration ratio.

Mowles teaches a high efficiency solar cell produced with inexpensive materials. The photovoltaic layer comprises two semiconductor layers to produce a p/n junction (paragraph 0052). Mowles further teaches the use of an insulating layer to electrically isolate the device. The insulating layer is made of silicon dioxide and has a thickness of 0.5 micrometers (paragraph 0049).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the material and thickness of the insulating layer of Mowles within the device of Takada because silicon dioxide has low cost, high availability of source chemicals and advanced technology of its deposition (Mowles paragraph 0049). Also the thickness is optimized for the specific application of an insulating layer and needs only to be sufficiently thick enough to be electrically insulating and pin-hole free (Mowles paragraph 0049). Thus the thickness of Mowles provides a low cost insulating layer free of defects that can corrupt the insulating properties of the layer

Kaplow teaches a solar radiation collection apparatus. The apparatus directs highly concentrated solar radiation upon a device such as a photovoltaic cell (abstract). These concentrations exceed 100 suns and especially in the range of 500 or more suns (column 1, paragraph 1). Figure 1 shows the apparatus concentrates the solar energy toward the front face of solar cell 10.

It would have been further obvious to one having ordinary skill in the art at the time the invention was made to incorporate the solar concentrator of Kaplow with the device of Takada in view of Mowles because the device allows the response of the cell to sun exposure to always be a maximum (Kaplow column 6, paragraph 2) and provides highly concentrated solar radiation to the solar cell (Kaplow column 2, paragraph 10). Because Kaplow and Takada in view of Mowles are concerned with photovoltaic cells, one would have a reasonable expectation of success from the combination. Thus the combination meets claims 12 and 14 through 17.

(10) Response to Argument

Ground 1. Rejection of claims 1-4, 7, 8 and 18-21 under 35 U.S.C. 103 over Takada in view of Mowles

In general, applicant argues that there is set forth no objective basis for combining the references and selecting the helpful portions while ignoring the unhelpful portions. Applicant argues that the insulating layer of Mowles is not at all relevant to that recited in the present claims and Mowles teaches against an insulator layer as recited in the claims. Applicant further argues there is no expectation of success from the combination and in fact an expectation of an absence of success as the insulating

layer of Mowles is in an entirely different application than that of Takada. Applicant also argues that the references do not teach some limitations of the claims. The examiner respectfully disagrees. First, the objective reasoning and motivation for the combination is stated above within the rejections. For example, Mowles provides several reasons for utilizing the oxide as the insulation material over other insulation materials. Mowles states that silicon dioxide has a low cost, high availability of source chemicals and advanced technology of its deposition (Mowles paragraph 0049). Second, the insulating layer of Mowles insulates the solar cell from a conductor (Mowles paragraph 0049). The insulating tape of Takada insulates the solar cell from a conductor. As the insulating layer of Mowles has the same function as the insulating tape of Takada, and both are utilized within a solar cell environment, it is the position of the examiner that the layer of Mowles is relevant. As for teaching against the insulator layer of the claims, while the device of Mowles does not have an insulating layer underneath a busbar, Mowles does not specifically teach that the insulating layer cannot be used under a busbar or that any insulation layer cannot be used under a busbar. Thus Mowles does not teach away from the combination. Third, as previously stated, the layer of Mowles and the insulating tape of Takada have the same function in the same type of application, namely insulation of a solar cell from a conductor. This is not an entirely different application and one of ordinary skill in the art would expect the insulating layer of Mowles to still work as an insulating layer in any other solar cell. The different location in Takada does not change the insulating properties of the material of Mowles

and thus there is a high expectation of success for the insulating materials of Mowles. Last, the rejections above point out the limitations of the claims.

Claims 1, 4

Applicant argues that the limitation "wherein the electrical insulator layer is an oxide or a nitride having a thickness of from about 0.3 to about 2 micrometers" is taught away from by Takada, while Mowles teaches away from the invention by teaching an insulating layer that does not overly and contact the front face of the solar cell. The examiner respectfully disagrees. As stated above, Takada does not disclose the specific insulator layer; that is the difference between Takada and the claims. However, this teaching does not preclude the use of other materials or other thicknesses for the layer. Mowles teaches the use of an oxide layer as an insulating layer, and teaches a number of advantages for using such material for an insulating layer. Mowles states that silicon dioxide has a low cost, high availability of source chemicals and advanced technology of its deposition (Mowles paragraph 0049). Also the thickness is optimized for the specific application of an insulating layer and needs only to be sufficiently thick enough to be electrically insulating and pin-hole free (Mowles paragraph 0049). Thus the thickness of Mowles provides a low cost insulating layer free of defects that can corrupt the insulating properties of the layer. Thus the silicon dioxide of Mowles is a functional equivalent insulator to the polyimide tape of Takada and has the advantages taught by Mowles. Therefore the use of silicon dioxide as the insulating material of Takada meets all the requirements of the claims and would be obvious to one of ordinary skill to make such a combination. As for teaching against the insulator layer of

the claims, while the device of Mowles does not have an insulating layer underneath a busbar, Mowles does not specifically teach that the insulating layer cannot be used under a busbar or that any insulation layer cannot be used under a busbar. Thus Mowles does not teach away from the combination.

Claim 2

Applicant argues that the references do not teach a photovoltaic energy source with exactly two layers of semiconductor material and there is no basis for the argument of using the two layers of Mowles. The examiner respectfully disagrees. As applicant's arguments over claim 2 also are included within the section for claim 3, the examiner's response will be within the claim 3 section below.

Claim 3

Applicant argues that the requirement of claim 3 for the photovoltaic energy source comprising more than two layers of semiconductor material and the examiner's rejection of the claim highlights the hindsight nature of the rejection. Specifically applicant argues that it is argued for claim 3 that Takada is to be used alone because it teaches more than two layers and it is argued for claim 2 that the teaching of Takada is to be combined with that of Mowles. Applicant further argues that the teaching is either no combination of references or a combination of references, but it cannot be both. The examiner respectfully disagrees. The rejection of claim 3 as stated above, is not over Takada alone as claim 3 requires a specific insulating material and thickness that is not disclosed by Takada. Since the solar cell of Takada already has more than two layers of semiconductor material, the combination as described for claim 1, meets all the

requirements for claim 3. In the case of claim 2, the reference to Mowles further teaches the common knowledge within the art of using exactly two layers of semiconductor material, and the reasoning to utilize such semiconductor layers. As claims 2 and 3 are mutually exclusive claims, the rejections of such claims can be mutually exclusive as well. The rejections are not hindsight in nature, but merely show the common knowledge at the time of both types of solar cells; ones with exactly two layers of semiconductor material, and ones with more than two layers of semiconductor material. The specific choice is dependent on the specific application and would be obvious to one of ordinary skill in the art.

Claim 7

Applicant again argues that the insulating layer of Mowles does not apply to the claimed invention. The examiner respectfully disagrees. As stated above, the layer of Mowles is functionally equivalent to the polyimide tape of Takada and the advantages taught by Mowles provide the motivation for the combination, including the thinner, cheaper layer.

Claim 8

Applicant argues that the references do not teach the insulator layer extending laterally beyond the metallic busbar layer and the explanation of the rejection does not contend that they do. The examiner respectfully disagrees. As stated in the rejections above and within the previous office actions, Takada shows in figure 3A the insulator layer, 308, extends laterally beyond the metallic busbar, 306. This meets the claim requirements and has been explained in the previous office actions.

Claim 18

Applicant argues that the limitation "wherein the electrical insulator layer has a thickness of from about 0.3 to about 2 micrometers" is taught away from by Takada, while Mowles teaches away from the invention by teaching an insulating layer that does not overly and contact the front face of the solar cell. The examiner respectfully disagrees. As stated above, Takada does not disclose the specific insulator layer; that is the difference between Takada and the claims. However, this teaching does not preclude the use of other materials or other thicknesses for the layer. Mowles teaches the use of an oxide layer as an insulating layer, and teaches a number of advantages for using such material for an insulating layer. Mowles states that silicon dioxide has a low cost, high availability of source chemicals and advanced technology of its deposition (Mowles paragraph 0049). Also the thickness is optimized for the specific application of an insulating layer and needs only to be sufficiently thick enough to be electrically insulating and pin-hole free (Mowles paragraph 0049). Thus the thickness of Mowles provides a low cost insulating layer free of defects that can corrupt the insulating properties of the layer. Thus the silicon dioxide of Mowles is a functional equivalent insulator to the polyimide tape of Takada and has the advantages taught by Mowles. Therefore the use of silicon dioxide as the insulating material of Takada meets all the requirements of the claims and would be obvious to one of ordinary skill to make such a combination. As for teaching against the insulator layer of the claims, while the device of Mowles does not have an insulating layer underneath a busbar, Mowles does not specifically teach that the insulating layer cannot be used under a busbar or that any

insulation layer cannot be used under a busbar. Thus Mowles does not teach away from the combination.

Claim 19

Applicant argues that the requirement of claim 19 for the photovoltaic energy source comprising more than two layers of semiconductor material and the examiner's rejection of the claim highlights the hindsight nature of the rejection. Specifically applicant argues that it is argued for claims 3 and 19 that Takada is to be used alone because it teaches more than two layers and it is argued for claim 2 that the teaching of Takada is to be combined with that of Mowles. Applicant further argues that the teaching is either no combination of references or a combination of references, but it cannot be both. The examiner respectfully disagrees. The rejection of claims 3 and 19 as stated above, are not over Takada alone as claims 3 and 19 require a specific insulating material and thickness that is not disclosed by Takada. Since the solar cell of Takada already has more than two layers of semiconductor material, the combination as described for claims 1 and 18, meets all the requirements for claims 3 and 19. In the case of claim 2, the reference to Mowles further teaches the common knowledge within the art of using exactly two layers of semiconductor material, and the reasoning to utilize such semiconductor layers. As claims 2 and 3 or 19 are mutually exclusive claims, the rejections of such claims can be mutually exclusive as well. The rejections are not hindsight in nature, but merely show the common knowledge at the time of both types of solar cells; ones with exactly two layers of semiconductor material, and ones

with more than two layers of semiconductor material. The specific choice is dependent on the specific application and would be obvious to one of ordinary skill in the art.

Claim 20

Applicant argues that the limitation "the electrical insulator layer is an oxide or a nitride" is taught away from by Takada, while Mowles teaches away from the invention by teaching an insulating layer that does not overly and contact the front face of the solar cell. The examiner respectfully disagrees. As stated above, Takada does not disclose the specific insulator layer; that is the difference between Takada and the claims. However, this teaching does not preclude the use of other materials or other thicknesses for the layer. Mowles teaches the use of an oxide layer as an insulating layer, and teaches a number of advantages for using such material for an insulating layer. Mowles states that silicon dioxide has a low cost, high availability of source chemicals and advanced technology of its deposition (Mowles paragraph 0049). Also the thickness is optimized for the specific application of an insulating layer and needs only to be sufficiently thick enough to be electrically insulating and pin-hole free (Mowles paragraph 0049). Thus the thickness of Mowles provides a low cost insulating layer free of defects that can corrupt the insulating properties of the layer. Thus the silicon dioxide of Mowles is a functional equivalent insulator to the polyimide tape of Takada and has the advantages taught by Mowles. Therefore the use of silicon dioxide as the insulating material of Takada meets all the requirements of the claims and would be obvious to one of ordinary skill to make such a combination. As for teaching against the insulator layer of the claims, while the device of Mowles does not have an insulating

layer underneath a busbar, Mowles does not specifically teach that the insulating layer cannot be used under a busbar or that any insulation layer cannot be used under a busbar. Thus Mowles does not teach away from the combination.

Claim 21

Applicant argues that the references do not teach the insulator layer extending laterally beyond the metallic busbar layer and the explanation of the rejection does not contend that they do. The examiner respectfully disagrees. As stated in the rejections above and within the previous office actions, Takada shows in figure 3A the insulator layer, 308, extends laterally beyond the metallic busbar, 306. This meets the claim requirements and has been explained in the previous office actions.

Ground 2. Rejection of claims 9-11, 22 and 23 under 35 U.S.C. 103 over Takada in view of Mowles, and further in view of Kaplow

In general, applicant argues that the combination of Takada and Mowles is improper from the previous arguments, and further there is no reason to believe the polyimide insulator of Takada would be operable at the high temperature of the concentrator cells of Kaplow. Applicant further argues that this inoperability leads to no expectation of success. The examiner respectfully disagrees. Applicant is arguing that the polyimide tape of Takada would not operate under the concentrator conditions of Kaplow. However, the rejection of the examiner is for combining the concentrator elements of Kaplow with the combination of Takada and Mowles. In other words, the concentrator would be placed on the device of Takada with a silicon dioxide insulating

layer as in Mowles utilized in place of the polyimide tape. Therefore, applicant's arguments are not directed to the rejection of the examiner.

Claim 9

Applicant argues that the references to Takada and Mowles teach against the limitations of claim 1 and thus do not meet the claim requirements for the arguments stated above. Applicant further argues that the approaches taught by the references are not compatible with the high temperatures of a solar concentrator solar cell. The examiner respectfully disagrees. The examiner has already stated the reasoning behind the combination of Takada and Mowles and does not feel the combination is lacking. Further, as stated above, the combination for the rejection is the device of Takada with the insulation material of Mowles and the concentrator of Kaplow. As this insulation material is an oxide as required by the claims, this material is compatible with the high temperatures of a concentrator solar cell.

Claim 10

Applicant argues that the references to Takada and Mowles teach against the limitations of claim 1 and thus do not meet the claim requirements for the arguments stated above. Applicant further argues that the approaches taught by the references are not compatible with the high temperatures of a solar concentrator solar cell. The examiner respectfully disagrees. The examiner has already stated the reasoning behind the combination of Takada and Mowles and does not feel the combination is lacking. Further, as stated above, the combination for the rejection is the device of Takada with the insulation material of Mowles and the concentrator of Kaplow. As this

insulation material is an oxide as required by the claims, this material is compatible with the high temperatures of a concentrator solar cell.

Claim 11

Applicant argues that the references to Takada and Mowles teach against the limitations of claim 1 and thus do not meet the claim requirements for the arguments stated above. Applicant further argues that the approaches taught by the references are not compatible with the high temperatures of a solar concentrator solar cell. The examiner respectfully disagrees. The examiner has already stated the reasoning behind the combination of Takada and Mowles and does not feel the combination is lacking. Further, as stated above, the combination for the rejection is the device of Takada with the insulation material of Mowles and the concentrator of Kaplow. As this insulation material is an oxide as required by the claims, this material is compatible with the high temperatures of a concentrator solar cell.

Claim 22

Applicant argues that the references to Takada and Mowles teach against the limitations of claim 18 and thus do not meet the claim requirements for the arguments stated above. Applicant further argues that the approaches taught by the references are not compatible with the high temperatures of a solar concentrator solar cell. The examiner respectfully disagrees. The examiner has already stated the reasoning behind the combination of Takada and Mowles and does not feel the combination is lacking. Further, as stated above, the combination for the rejection is the device of Takada with the insulation material of Mowles and the concentrator of Kaplow. As this

insulation material is an oxide as required by the claims, this material is compatible with the high temperatures of a concentrator solar cell.

Claim 23

Applicant argues that the references to Takada and Mowles teach against the limitations of claim 18 and thus do not meet the claim requirements for the arguments stated above. Applicant further argues that the approaches taught by the references are not compatible with the high temperatures of a solar concentrator solar cell. The examiner respectfully disagrees. The examiner has already stated the reasoning behind the combination of Takada and Mowles and does not feel the combination is lacking. Further, as stated above, the combination for the rejection is the device of Takada with the insulation material of Mowles and the concentrator of Kaplow. As this insulation material is an oxide as required by the claims, this material is compatible with the high temperatures of a concentrator solar cell.

Ground 3. Rejection of claims 12 and 14 through 17 under 35 U.S.C. 103 over Takada in view of Mowles and further in view of Kaplow

In general, applicant argues that the combination of Takada and Mowles is improper from the previous arguments, and further there is no reason to believe the polyimide insulator of Takada would be operable at the high temperature of the concentrator cells of Kaplow. Applicant further argues that this inoperability leads to no expectation of success. The examiner respectfully disagrees. Applicant is arguing that the polyimide tape of Takada would not operate under the concentrator conditions of Kaplow. However, the rejection of the examiner is for combining the concentrator

elements of Kaplow with the combination of Takada and Mowles. In other words, the concentrator would be placed on the device of Takada with a silicon dioxide insulating layer as in Mowles utilized in place of the polyimide tape. Therefore, applicant's arguments are not directed to the rejection of the examiner.

Claim 12

Applicant argues that the limitation "the electrical insulator layer is an oxide or a nitride" is taught away from by Takada, while Mowles teaches away from the invention by teaching an insulating layer that does not overly and contact the front face of the solar cell. The examiner respectfully disagrees. As stated above, Takada does not disclose the specific insulator layer; that is the difference between Takada and the claims. However, this teaching does not preclude the use of other materials or other thicknesses for the layer. Mowles teaches the use of an oxide layer as an insulating layer, and teaches a number of advantages for using such material for an insulating layer. Mowles states that silicon dioxide has a low cost, high availability of source chemicals and advanced technology of its deposition (Mowles paragraph 0049). Also the thickness is optimized for the specific application of an insulating layer and needs only to be sufficiently thick enough to be electrically insulating and pin-hole free (Mowles paragraph 0049). Thus the thickness of Mowles provides a low cost insulating layer free of defects that can corrupt the insulating properties of the layer. Thus the silicon dioxide of Mowles is a functional equivalent insulator to the polyimide tape of Takada and has the advantages taught by Mowles. Therefore the use of silicon dioxide as the insulating material of Takada meets all the requirements of the claims and would be

obvious to one of ordinary skill to make such a combination. As for teaching against the insulator layer of the claims, while the device of Mowles does not have an insulating layer underneath a busbar, Mowles does not specifically teach that the insulating layer cannot be used under a busbar or that any insulation layer cannot be used under a busbar. Thus Mowles does not teach away from the combination.

Claim 14

Applicant argues that the limitation "wherein the electrical insulator layer has a thickness of from about 0.3 to about 2 micrometers" is taught away from by Takada, while Mowles teaches away from the invention by teaching an insulating layer that does not overly and contact the front face of the solar cell. The examiner respectfully disagrees. As stated above, Takada does not disclose the specific insulator layer; that is the difference between Takada and the claims. However, this teaching does not preclude the use of other materials or other thicknesses for the layer. Mowles teaches the use of an oxide layer as an insulating layer, and teaches a number of advantages for using such material for an insulating layer. Mowles states that silicon dioxide has a low cost, high availability of source chemicals and advanced technology of its deposition (Mowles paragraph 0049). Also the thickness is optimized for the specific application of an insulating layer and needs only to be sufficiently thick enough to be electrically insulating and pin-hole free (Mowles paragraph 0049). Thus the thickness of Mowles provides a low cost insulating layer free of defects that can corrupt the insulating properties of the layer. Thus the silicon dioxide of Mowles is a functional equivalent insulator to the polyimide tape of Takada and has the advantages taught by Mowles.

Therefore the use of silicon dioxide as the insulating material of Takada meets all the requirements of the claims and would be obvious to one of ordinary skill to make such a combination. As for teaching against the insulator layer of the claims, while the device of Mowles does not have an insulating layer underneath a busbar, Mowles does not specifically teach that the insulating layer cannot be used under a busbar or that any insulation layer cannot be used under a busbar. Thus Mowles does not teach away from the combination.

Claim 15

Applicant argues that the limitation "wherein the electrical insulator layer has a thickness of about 0.5 micrometers" is taught away from by Takada, while Mowles teaches away from the invention by teaching an insulating layer that does not overly and contact the front face of the solar cell. The examiner respectfully disagrees. As stated above, Takada does not disclose the specific insulator layer; that is the difference between Takada and the claims. However, this teaching does not preclude the use of other materials or other thicknesses for the layer. Mowles teaches the use of an oxide layer as an insulating layer, and teaches a number of advantages for using such material for an insulating layer. Mowles states that silicon dioxide has a low cost, high availability of source chemicals and advanced technology of its deposition (Mowles paragraph 0049). Also the thickness is optimized for the specific application of an insulating layer and needs only to be sufficiently thick enough to be electrically insulating and pin-hole free (Mowles paragraph 0049). Thus the thickness of Mowles provides a low cost insulating layer free of defects that can corrupt the insulating

properties of the layer. Thus the silicon dioxide of Mowles is a functional equivalent insulator to the polyimide tape of Takada and has the advantages taught by Mowles. Therefore the use of silicon dioxide as the insulating material of Takada meets all the requirements of the claims and would be obvious to one of ordinary skill to make such a combination. As for teaching against the insulator layer of the claims, while the device of Mowles does not have an insulating layer underneath a busbar, Mowles does not specifically teach that the insulating layer cannot be used under a busbar or that any insulation layer cannot be used under a busbar. Thus Mowles does not teach away from the combination.

Claim 16

Applicant argues that the references do not teach the insulator layer extending laterally beyond the metallic busbar layer and the explanation of the rejection does not contend that they do. The examiner respectfully disagrees. As stated in the rejections above and within the previous office actions, Takada shows in figure 3A the insulator layer, 308, extends laterally beyond the metallic busbar, 306. This meets the claim requirements and has been explained in the previous office actions.

Claim 17

Applicant argues that the references to Takada and Mowles teach against the limitations of claim 12 and thus do not meet the claim requirements for the arguments stated above. Applicant further argues that the approaches taught by the references are not compatible with the high temperatures of a solar concentrator solar cell. The examiner respectfully disagrees. The examiner has already stated the reasoning

behind the combination of Takada and Mowles and does not feel the combination is lacking. Further, as stated above, the combination for the rejection is the device of Takada with the insulation material of Mowles and the concentrator of Kaplow. As this insulation material is an oxide as required by the claims, this material is compatible with the high temperatures of a concentrator solar cell.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Anthony Fick

Conferees:

Nam Nguyen

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SUPERVISORY PATENT EXAMINER
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